NEWPORT 268

DIGITAL PYROMETER

OWNERS MANUAL

NEWPORT

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MODEL 268
DIGITAL PYROMETER
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WARRANTY

All products of Newport Electronics, Inc. (Newport) are warranted against defective material and workmanship for a period of one (1) year from the date of delivery. Newport will repair or replace all defective equipment returned to it (transportation charges prepaid) during the warranty period without charge provided there is no evidence that the equipment has been mishandled or abused.

If, during the period of this warranty, the product appears to have a defect in materials or workmanship, please call your local Newport representative or write directly to the Customer Service Department, Newport Electronics, Inc, 630 E. Young Street, Santa Ana, California, 92705, and describe the problem.

All products returned to Newport must be insured by sender and must be carefully packaged and adequately protected such as to prevent breakage from shock and rough handling that might occur during shipment; all applicable shipping charges, insurance, duties and taxes must be prepaid by sender.

INITIAL CHECKOUT PROCEDURE

See Section 2.1 for Unpacking and Inspection instructions.

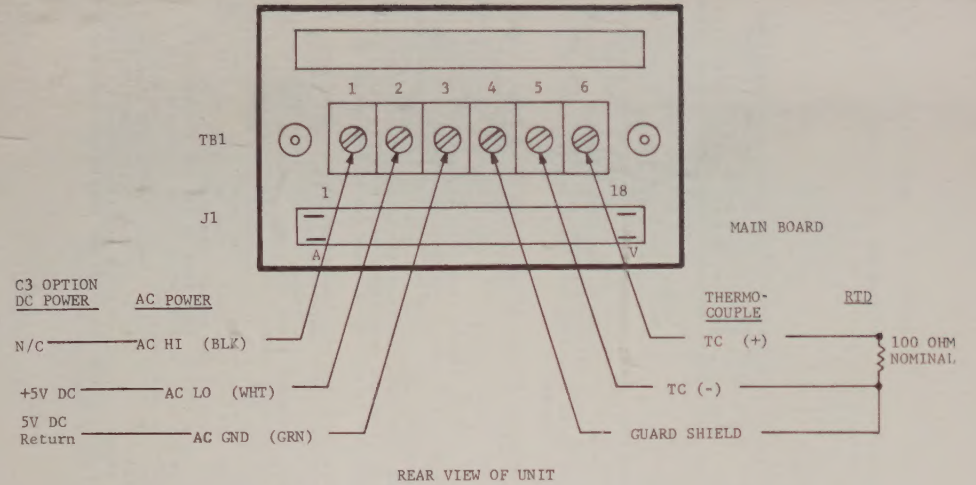
> **CAUTION**
>
> Meters are internally connected for either 115V or 230V AC power, or 5V DC power. Check label on meter for proper supply voltage.

REQUIRED EQUIPMENT

1. 115V or 230V 50-60 Hz power source (4.5 watts), or 5V DC at 750mA.
2. Three wire AC power cord, or a two wire DC power cord.
3. Flat blade screwdriver (1/4" blade).
4. Piece of copper buss wire.
5. 100 Ohm resistor.

TEST EQUIPMENT

1. Connect AC power as follows:
   a. AC power HI (Blk) to TB1-1.
   b. AC power LO (Wht) to TB1-2.
   c. AC power GND (Grn) to TB1-3.
2. Connect DC power as follows:
   a. +5V DC to TB1-2.
   b. 5V DC Return to TB1-3.
3. For Thermocouple Meters connect a piece of copper wire between TB1-5 and TB1-6.
4. Apply power and examine the display. The readout should show the approximate ambient temperature in ^{o}C or ^{o}F as applicable.
5. For RTD meters connect a 100 Ohm resistor between TB1-5 and TB1-6. Then connect a piece of copper wire between TB1-4.and TB1-5.
6. Apply power and examine the display. The readout should show approximately zero.



REAR VIEW OF UNIT

SECTION 1

DESCRIPTION

1.1 General

Dual slope integration with automatic zero correction is universally accepted as the most accurate method of analog to digital conversion. In the Model 268 this technique is further enhanced by the untilization of low noise input components to maintain noise levels below the resolution of the thermometer. Accuracy near the reference temperature of each range is not degraded by normal mode noise because the 268 performs true bipolar signal integration around zero. Many competitive meters rectify the signal before intergration which erroneously adds the absolute value of the normal mode noise to the signal reading. The 268 average value circuit provides full normal mode and superior AC line transient noise rejection at all signal levels.

An inherent feature of dual slope integration is the automatic rejection of AC line noise on the signal if the signal integration period is equal to a multiple of the AC line period. In the limit with precisly equal periods the AC line noise rejection is infinite. The Model 268 uses an accurate and stable oscillator which limits the instability of the signal measuring interval to within $\pm 1\%$ and provides 30 dB of normal mode rejection. An input filter provides an additional 30 dB of normal mode rejection. Overall, normal mode rejection is the sum of these two numbers of 60 dB.

Noble metal and some base metal thermocouples are described by the expression $emf = AT + BT^2$ in which emf is the output voltage, T is the temperature stimulus, and A and B are constants. Over the full range a thermocouple output can be divided into two or three intervals that are each described by an emf expression with different values for the constants. It should be noted that the two terms of the emf expression are the first terms of the series expansion of Ln(1-X). By utilizing Ln(1-X) functions to fit the thermocouple characteristic in the two or three intervals, the resulting conformity error is less than the thermocouple limits of error. Newport's POLYLOG linearizer (patent applied for) is equal in performance to 16 to 20 segment digital or diode function generator linearizer but without the drift and complexity problems of the diode function generator.

1.1 (Continued)

A platinum RTD is described by the expression $R_T = R_O(1 + CT - DT^2)$ in which R_T is the resistance at a given temperature, R_O is the resistance at 0 °C, T is the temperature stimulus, and C and D are constants. By subtracting the R_O term (offset) from the R_T expression one is left with two terms that are the first two terms of the series expansion of $Ln(1 + X)$. By utilizing one of at the most two $Ln(1 + X)$ functions to describe the Pt RTD over its entire range the resulting conformity error is less than 0.2%. Newport's POLYLOG linearizer (patent applied for) in this case is equal in performance to a 64 segment digital linearizer.

1.2 Specifications

1.2.1 Input

Configuration	Single-Ended
Polarity	Bipolar with Polarity Indicator
Zero	Automatic with negligible long term drift. Thermal emf's from input terminals, signal conditioning and basic meter is less than 0.15uV/°C.
Full Scale Voltage	20mV to 200mV
Overvoltage Protection ..	130V RMS for TC or 6Vp for RTD without damage
Impedance	100 Megohm
Bias Current	1 Nanoamp
Sensor Break Detection ..	60 Nanoamps current source with positive overload indication
Lead Resistance	250 Ohms max for rated TC accuracy. Add 0.005% R per Ohm of RTD conductor resistance to overall RTD accuracy.
NMR @ 50/60 Hz	60dB
CMR with 250 Ohm Imbalance	120dB AC power to Signal low. 120dB (opt) Digital Gnd to Signal low.
CMV (DC to 60 Hz)	500 volts peak.

1.2.2 Signal Conditioning

Reference Junction	From 10-40 C ambient, 0.03 deg/deg for base metals and 0.05 deg/deg for noble metals with 1 deg resolution. Sensor offset adjusted to zero from front panel.
RTD	From 10-40 C ambient, 0.02 deg/deg for platinum with 1.0 deg resolution. Sensor offset adjusted to zero from front panel.

1.2.3 Conversion

Technique	
TC	Dual Slope, Average value
RTD	Dual Slope ratiometric, average value
Signal Integration	100 milliseconds
Reading Rate	Int. 3/4sec, Ext. 0 to 3-4/sec.
Linearization	POLYLOG (patent applied for)

1.2.4 Display

Type	13mm, 7 segment LED
Symbols	0.0.0 to -1.9.9.9
Decimal Points	Any of Three
Overload	3 Least Significant Digits Flash.

1.2.5 Digital Signals

Logical '0'	0 to .6V	(Input)
	0 to .4V	(Output)
Logical '1'	2.0 to 5.5V	(Input)
	2.4 to 5.5V	(Output)
1 Unit Load	Logical '0' 1.6mA	
	Logical '1' .04mA	
Hold	'0' = Hold data	
	Input load = 1 Unit load	
Data Ready	'0' = Valid data	
	Output drive = 3 Unit loads	
BCD Parallel Data	'1' = True	
	Output drive = 3 Unit loads	
+ Polarity	'1' = Positive	
	Output drive = 1 Unit load	
Overload	'1' = Overload = 3 Unit loads	

1.2.6 Power

Input Voltage	115V $\pm$10% 50/60 Hz	
	230V $\mp$10% 50/60 Hz	Option C1
	100V $\mp$10% 50/60 Hz	Option C5
	5VDC $\mp$5% 750mA	Option C3
Input Power	4.5 watts at nominal input	
Output Voltage	+5V $\pm$10% @ 100mA	

1.2.7 General

Operating Temperature	0°C to 50°C
Storage Temperature	-25°C to 70°C
Humidity	Up to 95% at 40°C
Weight	540g or 1.2 lb.
Case Material	NORYL N190
Case Size	
Bezel (W x H x T).....	(96 x 48 x 6)mm or (3.78 x 1.89 x 0.24) in.
Depth Behind Bezel With Connector	135.4mm or 5.33 in.
Panel Coutout (W x H)...	(92 x 45)mm or (3.62 x 1.77) in.
Connectors	Barrier Strip, Signal and Power. 36 Pin connector, BCD output 36 Pin connector, options (Viking VK 18D/12, SAE SCC 18D/1-2, Winchester HSD 18SO)

1.2.8 Ranges

MODEL 268 TEMPERATURE SENSOR RANGES & ACCURACY @ 25°C

SENSOR TYPE	MATERIAL	RANGE	CONFORMITY ERROR	OVERALL ERROR + & LSD	RESOLUTION	MODEL
J	IRON CONSTANTAN	-210°C to 0°C	±1 0°C	±1 0°C	1°C	268JC
		0°C to 210°C	±1 0°C	±1 0°C		
		210°C to 760°C	1/8% Reading	1/8% Reading		
		300°F to 32°F	±3 0°F	±3 5°F	1 0°F	268JF
		32°F to 530°F	±2 0°F	±2 5°F		
		530°F to 1400°F	1/8% Reading	1/8% Reading		
K	CHROMEL ALUMEL	-180°C to 0°C	±2 0°C	±2 5°C	1 0°C	268KC
		0°C to 450°C	±1 0°C	±2 0°C		
		450°C to 1260°C	1/8% Reading	1/8% Reading		
		-284°F to 32°F	±2 5°F	±3 5°F	1 0°F	268KF
		32°F to 2000°F	±2 0°F	±2 5°F		
T	COPPER CONSTANTAN	-130°C to 400°C	±0 1°C	±0 8°C	0 1°C	268TC
		100 0°C to 200 0°C	±0 1°C	±0 1°C	0 1°C	268TC
		200°F to 700°F	±0 1°F	±1 1°F	0 1°F	268TF
		130 0°F to 200 0°F	±0 1°F	±0 1°F	0 1°F	268TF
		3?0°F to 370°F	±0 1°F	±1 1°F	0 1°F	268TF
E	CHROMEL CONSTANTAN	-183°C to 0°C	±2 0°C	±2 5°C	1 0°C	268EC
		0°C to 316°C	±1 25°C	±1 1°C		
		316°C to 871°C	1/8% Reading	1/8% Reading		
		330°F to 32°F	±3 0°F	±3 5°F	1 0°F	268EF
		32°F to 600°F	±2 5°F	±3 0°F		
		600°F to 1600°F	1/8% Reading	1/8% Reading		
RTD	PLATINUM 100 OHMS DIN 43760	-210°C to 0°C	±0 2°C	±0 3°C	1 0°C	268PC
		0°C to 100°C	±0 2°C	±0 3°C		
		100°C to 800°C	±0 2% Reading	±0 25% Reading		
		330°F to 32°F	±0 1°F	±0 8°F	1 0°F	268PF
		32°F to 212°F	±0 1°F	±0 8°F		
		212°F to 1500°F	±0 2% Reading	±0 25% Reading		
		-200 0°C to 200 0°C	±0 1°C	±0 3°C	0 1°C	268PC2
		-200 0°F to 200 0°F	±0 1°F	±0 4°F	0 1°F	268PF
R	PLATINUM-13% RHODIUM	-50°C to 0°C	±1 0°C	±2 0°C	1°C	268RC
		0°C to 580°C	±2 0°C	±2 0°C		
		580°C to 1750°C	±3 0°C	±4 0°C		

Conformity errors are with respect to thermocouple reference tables based on the IPTS-68 and DIN 43760, September 1968, for platinum RTD.

Overall error includes all error sources (basic meter, signal conditioner, linearizer conformity, etc.) @ 25°C.

Long Term Stability..... 0.15% error/yr.

SECTION 2

RECEIVING AND INSTALLATION

2.1 Unpacking and Inspection

Your Model 268 was fully inspected and tested, then carefully packed before shipment. Unpack the meter carefully and inspect it for obvious shipping damage.

2.2 Mechanical Installation

The Outline and Mounting drawing on the last page illustrates the mounting method for your digital pyrometer. The unit is inseted from the front of the panel and held in place by two slide retainers. The panel thickness may be between .75mm (.030") and 6.35mm (.25").

SECTION 3

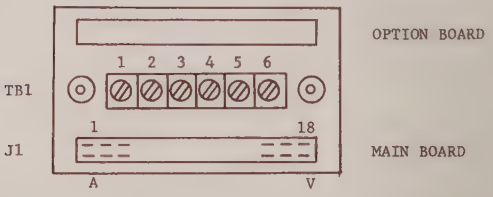
OPERATING INSTRUCTIONS

3.1 Pin Assignments

3.1.1 Connector TB1

		POWER
TB1-PIN	AC OPERATION	5 DC OPERATION
1	AC Power HI	N/C
2	AC Power LO	+ 5 Volts
3	AC Power GND	5V Return

	FUNCTION	
TB1-PIN	TC OPERATION	RTD
4	AC Guard Shield	
5	TC (-) Input	
6	TC (+) Input	



REAR VIEW OF UNIT

Figure 2

3.1.2 Connector J1

J1-PIN	FUNCTION	J1-PIN	FUNCTION
1	No Connection	A	Spare
2	Spare	B	No Connection
3	No Connection	C	Spare
4	$\overline{\text{Blank}}$	D	1 Bit
5	COMP	E	2 Bit
6	SIG	F	4 Bit
7	Clock	H	8 Bit
8	80 Bit	J	100 Bit
9	40 Bit	K	200 Bit
10	20 Bit	L	400 Bit
11	10 Bit	M	800 Bit
12	1K Bit	N	+ Polarity
13	Spare	P	$\overline{\text{Data Ready}}$
14	Spare	R	$\overline{\text{Hold}}$
15	+5V	S	$\overline{\text{Ext OL (In)}}$
16	Signal Gnd	T	Digital Gnd
17	Signal In	U	$\overline{\text{Conv}}$
18	OL	V	REF

Connector Type Viking		
	Viking	VK18D/12
	SAE	SAC18D/12
	Winchester	HSD18S0

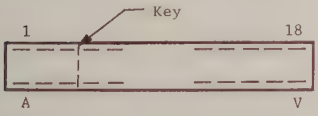


Figure 3
Connector Pin Orientation as Viewed From the Rear of the Meter.

3.2 Power

3.2.1 Input Voltage

The standard meter, option 02, operates from 115V ±10%, 60 Hz. It consumes about 4.5 watts. A three wire connection should be used to connect power to the meter. Two conductors provide power and the third provides a ground for noise rejection.

Option 03 is 230V ±10%, 50 Hz operation. To change the meter in the field, from 115 to 230V operation, use the following procedure. See Figure 3

(1) Remove power lines from meter and remove the meter form the case.

(2) Remove the two jumpers on the transformer W1 and W2.

(3) Add jumper W3 on the printed circuit board. The meter is now wired for 230V.

To change the meter from 230V to 115V operation, reverse the above steps.

3.2.2 Input Fuse

The power input to the Model 268 is protected by a carbon composition resistor fuse. If the meter does not light and it is suspected that the fuse has been blown, check the continuity of the primary circuit. The resistance from power Hi to power Lo will be approximately 180 ohms for 115V meter and 700 ohms for the 230V meter. If the fuse is blown, it is imperative that it is replaced by an identical part, failure to do so will void the warranty. The fuse is an Allen-Bradley 1/8W, 10 ohm, ±10% carbon composition resistor Newport part number 8111109.

3.2.3 Output Voltage

The +5V output is a regulated supply. A maximum current of 100mA is available for external use.

3.3 Signal Input

3.3.1 Signal

For best results a shielded thermocouple should be used for the input signal, with the shield terminated to Signal Ground at the connector TB1-4.

Singal Ground and Digital Ground are internally connected and should not be connected externally.

3.3.2 Ground Precautions

All Digital Signals used should be returned to Digital Ground Pin T.

Analog Ground Pin 16 or TB1-4 may be used for a shielded thermocouple or RTD cable IF SHIELD IS NOT RETURNED TO DIGITAL GROUND AT ANY POINT.

3.4 Digital Signal Outputs

3.4.1 BCD Parallel

All BCD outputs are TTL and DTL compatible.

Logical '1'	2.4 to 5.1V, source 0.12mA
Logical '0'	0 to 0.4V, sink 4.8mA

The data outputs are parallel BCD. The outputs are stable and valid while Data Ready (pin P) is low.

3.4.2 + Polarity

Logical '1'	2.4 to 5.1V, source 0.08mA
Logical '0'	0 to 0.4V, sink 1.6mA

The + Polarity output is a logical '1' when the meter indicates a positive reading.

3.4.3 $\overline{\text{Data Ready}}$

Logical '1'	2.4 to 5.1V, source 0.12mA
Logical '0'	0 to 0.4V, sink 4.8mA

$\overline{\text{Data Ready}}$ will go to a logical '0' at the end of a conversion cycle and to a logical '1' at the beginning of a conversion cycle.

3.4.4 Overload

Logical '1'	2.4 to 5.1V, source 0.12mA
Logical '0'	0 to 0.4V, sink 4.8mA

Overload will go to a logical '1' if the display is equal to or greater than the internal overload set point or when Pin S $\overline{\text{Ext. OL In}}$ is forced low by external command. It is stable while Data Ready is low. The Overload bit will reset during each conversion cycle.

3.4.5 $\overline{\text{Conv.}}$

Logical '1'	2.4 to 5.1V, source 0.32mA
Logical '0'	0 to 0.4V, sink 6.4mA

$\overline{\text{Conv.}}$ will go to a logical '0' at the beginning of a conversion cycle and to a logical '1' at the end of a conversion cycle.

3.4.6 Clock

Logical '1'	2.4 to 5.1V, source 0.12mA
Logical '0'	0 to 0.4V, sink 4.8mA

Clock is factory set at 20KHz +1%. It is available during the conversion cycle and if gated off with (SIG) signal time it can be used as a serial BCD output.

3.4.7 SIG

Logical '1'	2.4 to 5.1V source 0.12mA
Logical '0'	0 to 0.4, sink 4.8mA

SIG will go to a logical '1' at the beginning of signal integrated and will go to logical '0' at the end of signal integrate.

3.4.8 REF

Logical '1'	2.4 to 5.1V, source 0.12mA
Logical '0'	0 to 0.4V, sink 4.8mA

REF will go to a logical '1' at the beginning of reference integrate and will go to logical '0' at the end of reference integrate.

3.5 Digital Signal Inputs

3.5.1 $\overline{\text{Hold}}$

Logical '1'	2.0V, source 0.16mA
Logical '0'	0.8V, sink 3.2mA

When a logical '0' is applied to the $\overline{\text{Hold}}$ input, the meter will finish the conversion cycle it is on and will hold that reading. If it is applied before the beginning of a conversion, the meter will not start that conversion. Upon a logical '1' at the $\overline{\text{Hold}}$ input, a new conversion will begin within 360msec.

3.5.2 $\overline{\text{EXT OL In}}$

Logical '1'	2.7V, source .040mA
Logical '0'	0.4V, sink 1.2mA

When a external control signal is wired to Pin S and goes to a logical '0', the three least significant digits will flash.

3.5.3 $\overline{\text{Blank}}$

Logical '1'	2.4V, source 0.12mA
Logical '0'	0.4V, sink 3.6mA

When a logical '0' is applied to the $\overline{\text{Blank}}$ input, the three least significant digits will go blank.

3.5.4 Comp.

Logical '1'	1.5V, source 0.0mA
Logical '0'	0.8V, sink 4.8mA

3.5.5 Decimal Points

Any of three decimal points can be lighted by connecting the appropriate jumper with a bridge of solder as shown in Figure 4.

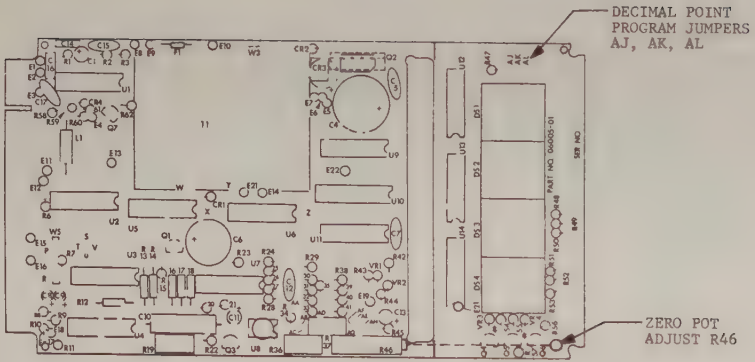


Figure 4

SECTION 4

ADJUSTMENT AND CALIBRATION

4.1 The Model 268 was calibrated at the factory with a precision source. Frequent calibration is not necessary due to the stability and internal accuracy of the meter. All adjustments are sealed except the zero adjustment which is accessible with the lens removed.

If calibration is required, return to the factory for calibration. Be sure to pack in a shipping container of sufficient size to allow ample packing material around unit to prevent damage in shipping.

4.2 Calibration Verification for Thermocouples.

The following procedure should be used to verify the calibration of thermocouple type meters.

1. Connect test cables as shown in Figure 5.
2. Apply power and allow meter to warm up for ten minutes.
3. Apply zero volts from calibrated voltage source and verify readout of 000°C or 032°F. Adjust zero pot if required (See Figure 4 for location).
4. Verify that the 268 is calibrated to the international practical Temperature Scale, IPTS-68, as published in NBS Monograph 125 issued March 1974 or ASTM E230-72 or ASA C96.2-1973.

4.3 Calibration Verification for RTD's

The following procedure should be used to verify the calibration of RTD type meters.

1. Connect test cables as shown in Figure 6.
2. Apply power and allow meter to warm up for ten minutes.

4.3 (Continued)

3. Apply appropriate resistance from the calibrated resistance source from DIN 43760, September 1968. This calibration, with a = .00385, is for specially processed platinum with improved stability in industrial environments.

NOTE: Reference Paragraphs 4.2 and 4.3 see Temperature Range and Accuracy Chart 1.2.8.

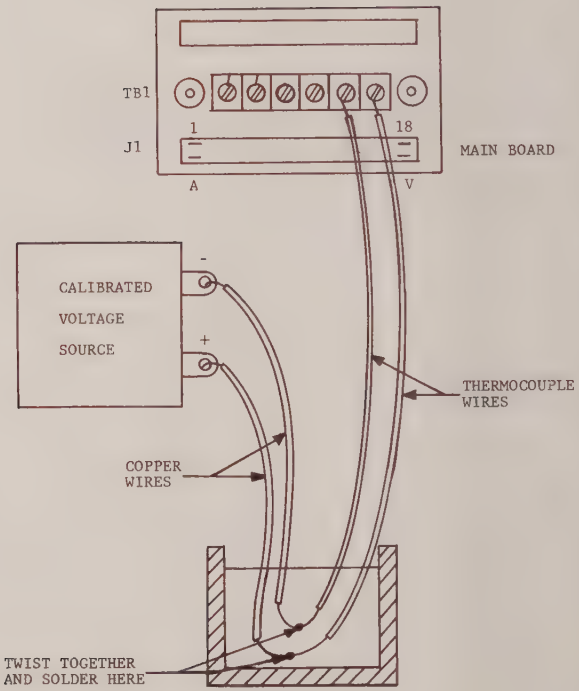
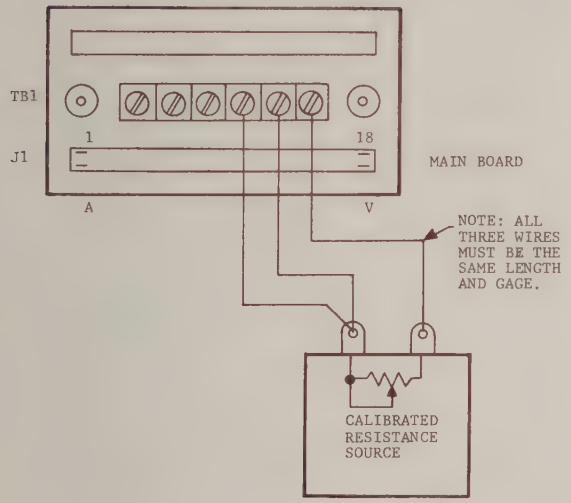

TB1
J1
1
18
MAIN BOARD
A
V
CALIBRATED
VOLTAGE
SOURCE
-
+
THERMOCOUPLE
WIRES
COPPER
WIRES
TWIST TOGETHER
AND SOLDER HERE
ICE BATH

Figure 5

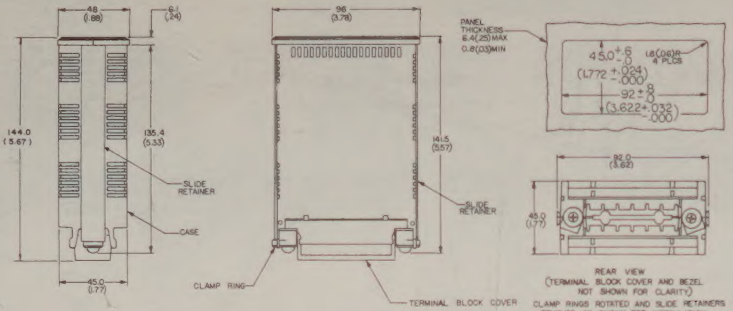
REAR VIEW OF UNIT



3 WIRE RTD CALIBRATION

Figure 6

CHG	E.O. NO.	DATES	BY	CHK
A	RELEASE	11-10-71	JC	[illegible]
B	2507	8-17-77	AR	[illegible]
C	NONE	3-4-80	VS	[illegible]



NOTES: DIMENSIONS IN MILLIMETERS ±.25 MM
AND IN (INCHES) ±.01 IN.

UNLESS SPECIFIED
OTHERWISE
DIMENSIONS ARE
TOLERANCES ARE
X ±
.X ±
.XX ±
.XXX ±
ANGULAR ±
DO NOT SCALE PRINT
MATERIAL
FINISH
DR
CHK
APP
MFG
QA

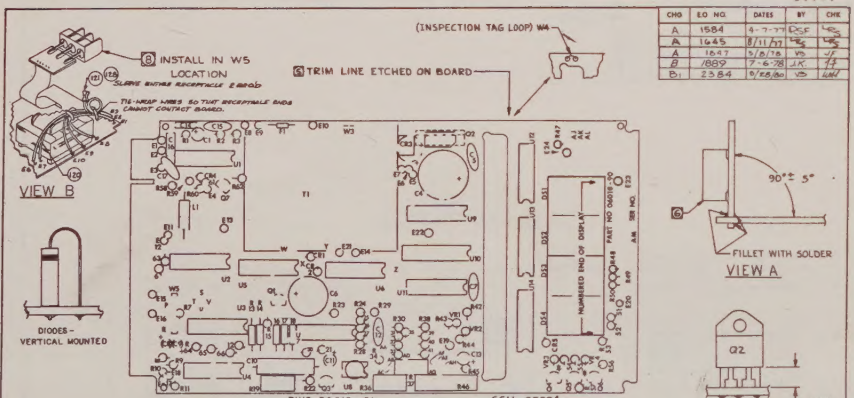
NEWPORT LABORATORIES, INC.
WORLD WAY ELECTRONICS
SANTA ANA, CALIFORNIA 92705

TITLE OUTLINE & MOUNTING
FOR DIN IA CASE

SIZE	CAGE SHEET NO.	REV.
C	32873	06896

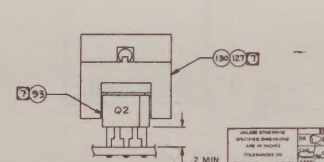
SCALE 1/1 | WORK DIN IA | SHEET 1 OF 1

CHG	EO NO.	DATES	BY	CHK
A	1584	4-7-77	DCE	
A	1645	8/11/77		
A	1647	9/8/78	VB	
B	1889	7-6-78	JK	
B1	2384	6/28/80	VB	



10 WHEN USING DIODE FOR Q3: CATHODE END TO COLLECTOR, ANODE END TO BASE.
9. FUNCTIONAL TEST PER 06009 SPECIFICATION.
8 IF OPTION RTD (06015-02) IS SELECTED, INSTALL AS SHOWN IN W5 PRIOR TO TEST.
7 APPLY THERMAL COMPOUND (ITEM 130) BETWEEN Q2 (ITEM 93) AND HEAT SINK (ITEM 127).
6 DENOTES NUMBERED END OF DS1 THRU DS4.
5 DETACH DISPLAY BOARD WHERE SHOWN AND ASSEMBLE PER VIEW "A".
4. RUBBER STAMP APPROPRIATE SERIAL NO.
3. REF. SCHEMATIC NO. 06007.
2. REF. PARTS LIST NO. 06018-90.
1. ASSEMBLE PER WORKMANSHIP MANUAL 02281-01.

NOTES: UNLESS OTHERWISE SPECIFIED



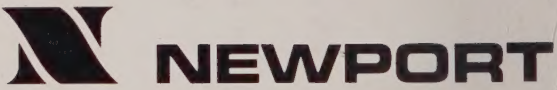
UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES	DR	
TOLERANCES ON:	CHK	
DECIMALS ANGLES	APPD	
.X = ± .03 ± 1°	MFG	
.XX = ± .01		
.XXX = ± .005		
DO NOT SCALE PRINT		
MATERIAL	FINISH	

NEWPORT LABORATORIES, INC.
630 E. YOUNG ST. SANTA ANA, CALIF. 92705

TITLE: ASSEMBLY DIAGRAM-
RTD, PYROMETER

CODE IDENT NO.	SIZE	NO.
32873	C	05994

SCALE 2/1 | MODEL 268 | SHEET 1 OF 1



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